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Reliability of Color Doppler Ultrasound in the Evaluation of Testicular Lesions

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Abstract:

Objective*: The objective of the study was to find out the reliability of Color Doppler Ultrasonography (CDUS) in the diagnosis of testicular lesions.* ***Methodology:*** *This cross-sectional type of study was carried out in the department of Radiology & Imaging of Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh to determine the value of Color Doppler Ultrasonography (CDUS) as a routine investigation method for diagnosis of testicular lesions. For this purpose, a total of 51 clinically suspected patients of testicular complains were included in this study with age range from 18 to 65 yrs. Color Doppler Ultrasonography (CDUS) was done in all these patients. Vascularity of the lesions, PSV (Peak Systolic Velocity), RI (Resistivity Index) were doppler variable which showed increased vascularity and PSV with decreased RI in maximum testicular lesions. They were followed up for the Final Clinical Diagnosis based on response to the medical treatment, Fine needle aspiration cytology (FNAC), histopathology and operative findings.* ***Result:*** *The reliability of CDUS was shown by kappa value which was 0.797 with a p value of <0.05. This measure of agreement was statistically significant with substantial agreement between CDUS & Final Diagnosis of testicular lesions.* ***Conclusion:*** *Color Doppler Ultrasonography imaging can be regarded as a reliable imaging modality in detecting testicular lesions.*

Key words*: Color Doppler Ultrasound, Testicular lesions*

Introduction:

Ultrasound is a sensitive and accurate technique for the evaluation of testicular abnormalities and is widely accepted as the first-line imaging technique for many common and uncommon testicular diseases. Ultrasound is effectively the sole scrotal imaging technique that a patient will undergo prior to surgery. Traditionally, B-mode ultrasound is extremely sensitive in the detection of testicular masses, but does not provide histological diagnosis. Currently, there are no ultrasound criteria that allow definitive differentiation of benign from malignant testicular lesions. Although not entirely diagnostic, ultrasound techniques such as color Doppler ultrasound (CDUS), Contrast-enhanced Ultrasound (CEUS) and Tissue Elastography (TE) in addition to B-mode imaging are available to provide a more detailed interrogation of focal testicular lesions.[1]

Color Doppler ultrasonography (CDUS) is an important tool for diagnosis of testicular diseases because of its ability to depict anatomy and perfusion in real time. Diagnosis of testicular diseases has always been a challenge for the clinician due to non-specific signs and symptoms. The common testicular lesions are torsion, trauma, neoplasms, and inflammatory conditions. Ultrasonography plays a major role in distinguishing intra-testicular from extra testicular abnormalities also. Color Doppler ultrasonography is an excellent, safe, and reliable method for evaluating patients with scrotal diseases.[2]

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Tissue Elastography (TE) is an ultrasound measure to assess the stiffness of tissue. Most solid focal tumors differ in their consistency from the surrounding tissue. TE is a further technique that allows better differentiation between benign and malignant testicular lesions. The 'hard' lesions are more likely to be malignant, and a 'soft' area may suggest benignity.[1]

Color Doppler ultrasonography has many advantages over conventional ultrasonography. In addition to detecting non-specific grey scale changes that can occur with testicular ischemia, it also shows blood flow in testicular arteries. Accurate clinical diagnosis of testicular diseases is difficult as most patients present with similar signs and symptoms. Color Doppler ultrasonography is currently the most important imaging modality available for diagnosis of scrotal pathologies. It allows accurate evaluation of scrotal conditions as well as normal anatomy.[3]

CDUS with its high sensitivity and specificity is the most important investigation for diagnosis of scrotal diseases, presenting especially in emergency clinical setting. But it has its own limitations, including difficulty in detecting intratesticular flow in small children and requiring adequate expertise and experience. Its results are also equipment dependent. Purpose of this study is to determine the reliability of Color Doppler ultrasonography (CDUS) as a routine investigational method for diagnosis of testicular pathologies.

Materials & Methods:

This cross sectional study was conducted in the Radiology and Imaging department of Bangabandhu Sheikh Mujib Medical University, Dhaka over a span of 24 months from July 2015 to June 2017. The study was approved by the ethical committee of the hospital and a written informed consent was taken from each patient. A total of 51 patients in the age range of 18 to 65 years old, with testicular pathologies were included in the study. After adequate history taking and physical examination, CDUS was performed. The patients were scanned with the linear Color Doppler multi-frequency (7 to 9 MHz) transducer using PHILIPS iu22 ultrasound machine. Sagittal and transverse images were obtained. Additional views were also obtained in coronal and oblique planes. Reliability of CDUS was determined by comparing it with the final diagnosis, which was based on clinical outcome (i.e. positive response to medical treatment), operative findings, fine needle aspiration cytology (FNAC), and histopathological examination results.

The aim and objective of the study along with its procedure, alternative diagnostic methods, risk and benefits were explained to the patients in easily understandable local language and then informed consent was taken from each patient. It was assured that all records would be kept confidential and the procedure would be helpful for both the physician and patients in making rational approach regarding management of the case.

Results & Observations:

The mean age was found 26.0 ± 14.9 years with range from 18 to 65 years. More than three fourth (80.4%) patients had pain, 34(66.7%) had H/O scrotal swelling, 15(29.4%) had fever and 08(15.7%) had H/O trauma.

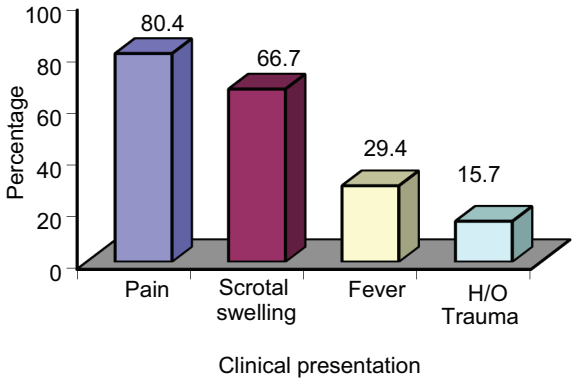

Fig 1: *Bar diagram shows clinical presentation of the study patients*

Almost two third (64.7%) of testicular lesions were hypoechoic. Almost three fourth (70.6%) testicular lesions had increased vascularity, 28 (54.9%) testicular lesions had increased PSV (Peak systolic velocity), 31(60.8%) testicular lesions had decreased RI (Resistivity index). Two third (66.7%) patients were diagnosed as orchitis, 05(9.8%) as seminoma and 04(7.8%) as abscess in Color Doppler Ultrasound. Almost half (49.0%) patients were managed conservatively and Final Clinical

Diagnosis were made observing the response to medical treatment only, in 21(41.2%) patients FNAC was performed for a diagnosis and 05(9.8%) patients underwent surgery for establishing the final diagnosis.

Table-I

Distribution of the study patients by Color Doppler Ultrasound (CDUS) diagnosis of testicular lesions (n=51)

CDUS diagnosis of Testicular lesions	No of Patients	Percentage
Orchitis	34	66.7
Seminoma	05	9.8
Abscess	04	7.8
Torsion	05	9.8
Haematoma	03	5.9

A total of 34 patient had orchitis in CDUS diagnosis, among them 31(92.8%) patients had orchitis in final clinical diagnosis. 05 patients had seminoma in CDUS diagnosis, among them 04(80%) patients had seminoma in final clinical diagnosis. 04 patients had abscess in CDUS diagnosis, among them 04(100%) patients had abscess in final clinical diagnosis. 05 patients had torsion in CDUS diagnosis, among them 04(80%) patients had torsion in final clinical diagnosis. 03 patients had hematoma in CDUS diagnosis, among them 01(33.3%) patients had hematoma in final clinical diagnosis.

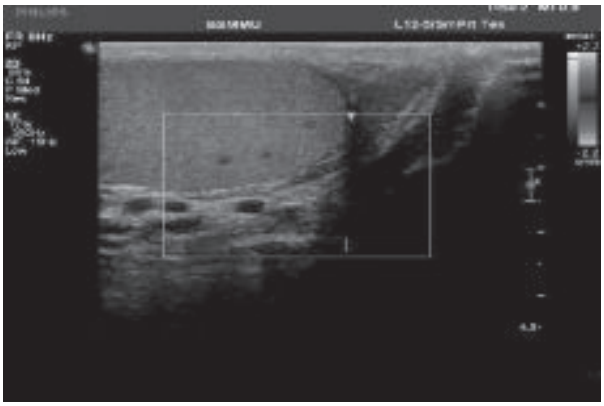

Fig 2: *Normal Testis-Color Doppler scan showing echogenicity & vascularity of normal testis.*

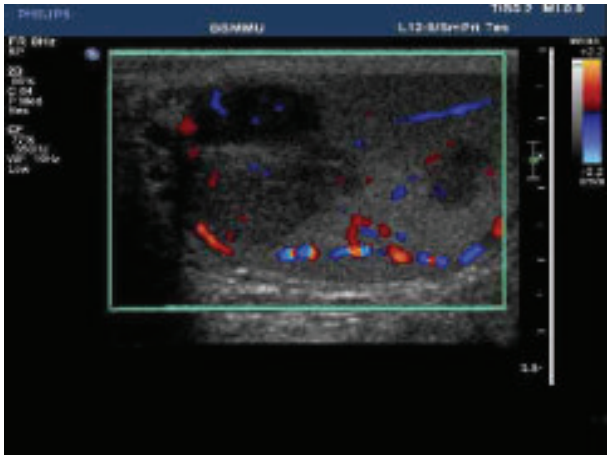

Fig 3: *Testicular Seminoma-Color Doppler scan showing multiple hypo echoic testicular lesions with increased vascularity.*

Table-II

Agreement (Reliability) of Color Doppler ultrasound diagnosis with Final Clinical Diagnosis of testicular lesions (n=51)

CDUS Diagnosis	Final Clinical Diagnosis (on the basis of final outcome, FNAC and surgery)									
	Orchitis (n=31)		Seminoma (n=7)		Abscess (n=6)		Torsion (n=4)		Hematoma (n=3)	
	n	%	n	%	n	%	n	%	n	%
Orchitis (n=34)	31	92.8	3	7.2	0	0	0	0	0	0
Seminoma (n=5)	0	0	4	80	0	0	0	0	1	20
Abscess (n=4)	0	0	0	0	4	100	0	0	0	0
Torsion (n=5)	0	0	0	0	0	0	4	80	1	20
Haematoma (n=3)	0	0	0	0	2	66.7	0	0	1	33.3
Kappa value	0.797									
p value	0.001s									

The results of the two modalities (CDUS and Final Clinical Diagnosis) analysis found a Kappa value 0.797 and a p value of <0.05. This measure of agreement is statistically significant with substantial agreement between CDUS & Final Clinical Diagnosis in the evaluation of testicular lesions.

Discussion:

This cross sectional observational study was carried out with an aim to determine the value of Color Doppler ultrasonography (CDUS) as a routine investigational method for the diagnosis of testicular lesions.

A total of 51 consecutive patients were attended in Department of Radiology and Imaging during July 2015 - June 2017. Clinically diagnosed testicular lesion and age between 18 to 65 years old were enrolled in this study. Inguino-scrotal hernia and undescended testis were excluded from the study. The present study findings were discussed and compared with previously published relevant studies. In this present study, it was observed that more than two third (68.6%) patients belonged to age 21-30 years. The mean age was found 26.0 ± 14.9 years with range from 17 to 65 years. Rizvi et al[4] observed 122 patients in the age range of 13 to 70 years old. The higher mean age and age range in our study could be due to geographical variations, racial, ethnic differences and genetic causes may have significant influence on testicular lesions. In this current series, it was observed that more than half (51.0%) patients were unmarried and 49.0% were married.

In this present study, it was observed that more than three fourth (80.4%) patients with testicular lesions had pain. In this current study, it was observed that 29.4% patients with testicular lesions had fever. Although the most common presenting complain is painless testicular enlargement, systemic symptoms such as weight loss, anorexia, fever and weakness have been reported as the initial complain in 25% of patients which is comparable with the current study. During physical examination, it was observed in this present study that almost two third 60.8% patients had raised pulse, 19.6% raised temperature, 60.8% scrotal tenderness and 62.6% patients had scrotal swelling. In this current series, it was observed that 15.7% and 66.7% patients had H/O trauma and scrotal swelling respectively. Lung et al[5] found in their study that all of the patients presented with scrotal pain.

In this current study, it was observed that more than three fourth (76.5%) patients had diffuse and 23.5% had focal type of testicular lesion. Lung et al[5] found in their study that More than three fourth (56.0%) of testicular lesions were diffuse.

In this present study, it was observed that almost two third (64.7%) of the patients had hypoechoic lesion and 25.5% had mixed echogenic lesion. Rizvi et al[4] observed that the testis was also hypoechoic and hyperemic in orchitis.

In this current study, it was observed that almost three fourth (70.6%) patients had increased vascularity of the lesion and 7.8% showed absent blood flow. In this current study, it was observed that more than half (54.9%) patients had increased PSV (Peak systolic velocity). Almost two third (60.8%) patients had decreased RI (Resistivity index) and 21.6% had normal RI. We also noted that elevated velocity values observed both in patients with testicular tumor and orchitis did not allow any diagnostic differentiation based on Doppler criteria at the initial examination. Elevated PSV has been noted by Horstman et al[6] in testicular tumors. On the contrary, follow-up examination on completion of 1-week proper antibiotic treatment showed normalization of velocity values in patients with orchitis while persistent high velocities were seen in patients with tumor. This suggests that follow-up examination is important in patients with acute scrotal pain submitted to antibiotic treatment since it may permit a reliable differentiation between orchitis and tumor. Rizvi et al[4] mentioned that maximum patients were conservatively managed and follow-up CDUS revealed resolution of findings.

In this study, it was observed that 66.7% patients had orchitis, 9.8% patients had seminoma, 9.8% torsion, 7.8% abscess and 5.9% haematoma in CDUS. In this series, it was observed that almost half (49.0%) of study patients were managed conservatively and Final Clinical Diagnosis were made observing the response to medical treatment, 41.2% patients were performed FNAC, 9.8% patients underwent surgery and finally diagnosed accordingly. Regarding the Final

Clinical Diagnosis in this current study, it was observed that almost two third (60.8%) patients had orchitis, 13.7% patients had seminoma, 11.7% patients had abscess, 7.8% torsion and 5.9% had hematoma.

In this present study total 34 patient had orchitis in CDUS diagnosis, among them 31(92.8%) patients had orchitis in final clinical diagnosis. 05 patients had seminoma in CDUS diagnosis, among them 04(80%) patients had seminoma in final clinical diagnosis. 04 patients had abscess in CDUS diagnosis, among them all 04(100%) patients had abscess in final clinical diagnosis. 05 patients had torsion in CDUS diagnosis, among them 04(80%) patients had torsion in final clinical diagnosis. 03 patients had haematoma in CDUS diagnosis, among them 02(66.7%) patients had haematoma in final clinical diagnosis. The results of the two modalities (CDUS and Final Clinical Diagnosis findings) analysis found a Kappa value = 0.797 with a p value of <0.05. This measure of agreement is statistically significant with substantial agreement between CDUS & Final Clinical Diagnosis in the evaluation of testicular lesions.

Conclusion:

This study was undertaken to determine the reliability of Color Doppler Ultrasonography (CDUS) as a routine investigational method for diagnosis of testicular lesions. Color Doppler Ultrasonography has definite value in the diagnosis and evaluation of testicular lesions and can be regarded as a reliable imaging modality.Color Doppler Ultrasonography imaging is efficient imaging modality in detecting testicular lesions as well as vascularity of the lesions. Hence, it should be worthy to note that Color Doppler Ultrasonography can help the physician and surgeon in the rational approach of patient management and mapping of the testicular lesion pre-operatively.

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